REMARKS / DISCUSSION OF ISSUES

Claims 1-20 are pending in the application.

The Office action rejects claim 11 under 35 U.S.C. 101. The applicant respectfully traverses this rejection.

The Office action asserts that claim 11 recites "non-functional descriptive material". The applicant respectfully disagrees with this assertion. Claim 11 clearly recites that the computer program causes a processor to perform particular functions; as such, the recited computer program cannot be said to be "non-functional".

MPEP 2106.01 states:

> "In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component…
> "When functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized…
> "[A] claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory."

Because the applicant specifically claims a computer media that includes a computer program product operative to cause a processor to perform particular functions, the applicant respectfully maintains that the rejection of claim 11 under 35 U.S.C. 101 is unfounded, per MPEP 2106.01, and should be withdrawn.

The Office action rejects claims 1-20 under 35 U.S.C. 102(e) over Tsui et al. (USPA 2007/0163425, hereinafter Tsui). The applicant respectfully traverses this rejection.

Tsui fails to teach independently searching a melody database for a closest match for each sub-string of a plurality of query sub-strings, and fails to teach determining at least a closest match for the query string based on the search results for the respective sub-strings, as specifically claimed in claim 1, upon which claims 2-11 depend. Claim 11 and claim 12, upon which claims 13-20 depend, include similar features.

Tsui specifically teaches searching a melody database for a closest match for a single query string (X in FIG. 10):

> "The engine 16 sets up a 2-dimensional matrix 180 for each song matching, as exemplified in FIG. 10. The Y-axis of the matrix 180 represents a string $Y=(Y_1,Y_2, \ldots ,Y_m)$ from the differential note and timing file of the candidate song where each entry Y_i is a tuple or vector (YRF_i, YRT_i). YRF represents the pitch ratio and YRT represents the beat duration ratio of the corresponding entry. The X-axis of the matrix 180 represents a string $X=(X_1,X_2, \ldots ,X_n)$ from the differential note and timing file 150 generated by the note conversion subsystem 12." (Tsui, [0088].) And,
>
> "The objective of the song-matching algorithm is to find the subsequence of Y with the minimum matching cost with X. The score of matching is thus the cost of matching. The lower the score, the better the match. If there is no insertion or deletion error in the input differential note and timing file 150, then the cost of matching the string $(X_1,X_2, \ldots ,X_n)$ with a sub-string $(Y_j, \ldots ,Y_{j+n-1})$ in Y is given by the following recursive formula:
>
> $\text{min\_match\_cost}((X_1,X_2, \ldots ,X_n), (Y_j, \ldots ,Y_{j+n-1}))=$
> $\text{match\_cost}(X_n,Y_{j+n-1})+\text{min\_match\_cost}((X_1,X_2, \ldots ,X_{n-1}), (Y_j, \ldots ,Y_{j+n-2}))$.

Of particular note, Tsui consistently refers to a single string X for determining a score for the matching of this single string X to a sub-string in song Y, and Tsui's use of a recursive formula, wherein the cost of matching the string is dependent on the minimum cost of matching all of the notes of the string in sequence, further affirms that the scoring is based on the processing of the entire single stream X.

In attempting to find a correspondence between the applicant's claimed invention and Tsui, the Office action asserts that each note in Tsui's string can be considered a sub-string. However, if each note in a string is independently searched for a match within each song, as the Office action's assertion would require, the resultant output would be meaningless. If, for example, one of the notes in the string is "C", every song in the database that has a C-note somewhere within its recording would signal a match. Tsui does not teach searching for a match to each note in the query, and then determining whether a song matches the query based on the search results for each individual note, as asserted in the Office action, because such a technique would be unsatisfactory for its intended purpose of finding matching songs.

To effectively search for a song, the matching process must use a string of notes to properly distinguish songs that have the given string of notes from songs that do not have the given string of notes. The longer the string, the better the distinguishing properties, and hence the conventional query-song matching techniques, such as Tsui's, use an entirety of the string to find a match.

The Examiner's attention is requested to page 2, lines 5-14 of the applicant's specification, wherein some of disadvantages of attempting to find a match to a single query string are presented. By partitioning a query into a plurality of substrings, as taught by the applicant, the matching of each substring to each song is determined, independent of whether other substrings of the query appear in the song, and particularly, independent of whether these query substrings appear in a particular sequence within the song. In conventional query-song matching, such as Tsui, the entire string must appear in the given sequence within a segment of the song in order for a match to be found.

Because Tsui fails to teach independently searching a melody database for a closest match for each sub-string of a plurality of query sub-strings, and fails to teach determining at least a closest match for the query string based on the search results for the respective sub-strings, the applicant respectfully maintains that the rejection of claims 1-20 under 35 U.S.C. 102(e) over Tsui is unfounded, and should be withdrawn.

Tsui also fails to teach decomposing the query string into sub-strings that correspond to phrases of a melody, as claimed in claims 2 and 13. The Office action asserts that Tsui teaches sub-strings corresponding to each note of the query string. As is well known in the art, a "phrase of a melody" is not a single note, as asserted in the Office action.

Tsui also fails to teach iteratively determining, for each centroid corresponding to a sub-string of the query string, a respective centroid value in dependence on the sub-string associated with the respective centroid, and fails to teach determining, for each of the sub-strings, corresponding sub-string boundaries by minimizing a total distance measure between each of the centroids and the sub-string associated with the respective centroid until a predetermined convergence criterion is met, as claimed in claims 6 and 18. The Office action refers to the teachings of Tsui at paragraphs [0062] and [0067], which deal with techniques for identifying each note in a string, and does not refer to centroid values. The Office action subsequently refers back to Tsui's paragraphs [0011] and [0008] with an assertion that Tsui teaches how centroid values, which aren't taught by Tsui, are used.

Of particular note, the Office action asserts that Tsui's paragraph [0008] teaches repeating the claimed determining of centroid values and distances between centroids until a convergence criteria is met. The cited text teaches:

> "One aspect of the invention provides a method and system for converting a digitized melody into a series of notes. The method and system receive a digitized representation of an input melody, identify breakpoints in the melody in order to define notes therein, determine a pitch and beat duration for each note of the melody, and associate a confidence level with each breakpoint, or each note, or both." (Tsui [0008].)

As is readily apparent, the referenced text does not address repeating a process until a predetermined convergence criterion is met, as asserted in the Office action.

Tsui also fails to teach dividing a duration of the audio fragment by an average duration of a phrase, as claimed in claims 7 and 19. The Office action asserts that Tsui provides this teaching at paragraph [0010]. The cited text teaches:

> "In the preferred embodiment, segmentation of the input melody into distinct notes divided by breakpoints is based on changes or differences in the distribution of energy across the frequency spectrum over time. The confidence levels associated with each breakpoint and/or note may be based on changes in pitch, as well as absolute and relative values of a spectral energy distribution indicator." (Tsui [0010].)

As is clearly evident, at the cited text, Tsui teaches distinguishing notes based on the distribution of energy across the frequency spectrum over time, and does not teach distinguishing audio fragments based on an average duration of a phrase.

In like manner, review of the cited text of Tsui will reveal that Tsui does not teach the elements of claims 5 and 16 at paragraph [0048]; does not teach the elements of claim 8 at paragraph [0104]; does not teach the elements of claim 9 at paragraphs [0052]-[0055]; and does not teach the elements of claims 10 and 20 at paragraphs [0048] and [0050]-[0051].

In view of the foregoing, the applicant respectfully requests that the Examiner withdraw the objection(s) and/or rejection(s) of record, allow all the pending claims, and find the application to be in condition for allowance. If any points remain in issue that may best be resolved through a personal or telephonic interview, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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